$z = f(x,y) = 2(x-1)^2 + 4(y-3)^2 + 6$

$P(2,-2,12)$

$z - z_0 = f_x(x_0,y_0)(x-x_0) + f_y(x_0,y_0)(y-y_0)$

$\frac{\partial z}{\partial x} = 2(x^2-2x+1)$ $\quad$ $2x^2-4x+2$

$\frac{\partial z}{\partial y} = 4(y-3)^2$ $\quad$ $4(y^2-6y+9)$ $\quad$ $4y^2-24y+36$

$\frac{\partial z}{\partial x} = 4x-4$

$\frac{\partial z}{\partial y} = 8y-24$

$\frac{\partial z}{\partial x}(2,2) = 4(2)-4$ $\quad$ $8-4=4$

$\frac{\partial z}{\partial y}(2,-2) = 8(-2)-24$ $\quad$ $-16-24$ $\quad$ -40

$z-12 = 4(x-2) + (-40)(y+2)$

$z = 4x-8-40y-80+12$

$z = 4x-40y-76$

$f(x,y) = \sqrt{y+\cos^2 x}$

Find lin approx at $(\pi,0)$

$\frac{\partial z}{\partial x} = (y+\cos^2 x)^{\frac{1}{2}}$

$u = \cos x$

$u^2 = \cos^2 x$

$2u \cdot u' = 2\cos x \cdot -\sin x$

$\frac{1}{2}(y+\cos^2 x)^{-\frac{1}{2}} \cdot -2\cos x \sin x$

$\frac{-2\cos x \sin x}{2\sqrt{y+\cos^2 x}}$

$\frac{\partial z}{\partial y} = \frac{1}{2}(1+\cos^2 x)^{-\frac{1}{2}} \cdot 1$

$\frac{\partial z}{\partial x} = \frac{-\cos x \sin x}{\sqrt{y+\cos^2 x}}$ $\qquad$ $\frac{\partial z}{\partial y} = \frac{1}{2\sqrt{y+\cos^2 x}}$

$\frac{\partial z}{\partial x}(\pi,0) = \frac{0}{0}$ $\qquad$ $\frac{\partial z}{\partial y}(\pi,0) = \frac{1}{2}$

$z-1 = 0(x-\pi) + \frac{1}{2}(y-0)$

$z-1 = \frac{1}{2}y$

$z = \frac{1}{2}y+1$

$\boxed{L(x,y) = z = \frac{1}{2}y+1}$

Defn: If $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$ are continuous in a neighborhood of (x_0,y_0) we say f is differentiable at (x_0,y_0)

$\lim_{h\to 0} \frac{f(a+h,b) - f(a,b)}{h}$

$\lim_{h\to 0} \frac{f(a,b+h) - f(a,b)}{h}$

$h=10$

$h=-10$

$f(v,t)$

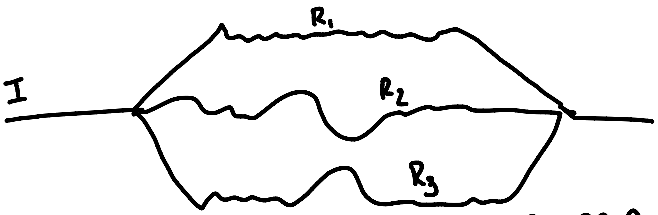
$f(40,20) = 28$

$\frac{\partial f}{\partial v}(40,20) \approx \frac{f(50,20)-f(30,20)}{50-30} = \frac{40-17}{20} = \frac{23}{20}$

$\frac{\partial f}{\partial t}(40,20) \approx \frac{f(40,30)-f(40,15)}{30-15} = \frac{31-25}{15} = \frac{6}{15}$

$h-28 = \frac{23}{20}(v-40) + \frac{6}{15}(y-20)$

$h = 28 + \frac{23}{20}(v-40) + \frac{6}{15}(y-20)$



Equivalent to a single resistance R

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$R_1 = 32\,\Omega$

$R_2 = 25\,\Omega$ $\quad$ $\pm 0.5\%$

$R_3 = 4\,\Omega$

$R = R(R_1,R_2,R_3)$ $\quad$ $R(32,25,4) = 3.1128$

$L(R_1,R_2,R_3) = \frac{\partial R}{\partial R_1}(32,25,4) + \frac{\partial R}{\partial R_2}(32,25,4) + \frac{\partial R}{\partial R_3}(32,25,4)$

$\frac{\partial R}{\partial R_1} = -\left(\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}\right)^{-2}\left(\frac{-1}{R_1^2}\right) \approx 0.00946$

$L(R_1,R_2,R_3) = 0.00946(0.005\cdot 32) + 0.0155(0.005\cdot 25) + 0.6056(0.005\cdot 4) + 3.1128$

$\frac{\partial R}{\partial R_2} = -\left(\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}\right)^{-2}\left(\frac{-1}{R_2^2}\right) \approx 0.0155$

$3.1281 - 3.1128$

$\frac{\partial R}{\partial R_3} = -\left(\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}\right)^{-2}\left(-\frac{1}{R_3^2}\right) \approx 0.6056$